An Investigation of Operant Elements in Desensitization: A Comparison of Differential Reinforcement of Other Behaviors and Desensitization in the Reduction of Phobic Responses in Rats

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To

My Wife

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OF PHOBIC RESPONSES IN RATS

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An animal analogue study was designed to compare the effects of desensitization and operant conditioning in reducing phobic behaviors. The intent of this comparison was to investigate operant elements in desensitization rather than to evaluate the relative efficacy of the two treatments.

On the basis of previous research an explanation of desensitization in terms of operant rather than classical conditioning principles was thought to be feasible, leading to the following hypotheses:

1. An operant treatment procedure similar to an operant procedure possible in desensitization and presented within the framework of desensitization facilitates the extinction of phobic behaviors more so than a desensitization treatment in which operant elements are minimized, thereby demonstrating the dependence of desensitization on operant conditioning.

2. Both the operant and desensitization procedures facilitate the extinction of phobic behaviors to a greater extent than does a

control procedure, thereby demonstrating treatment effects.

To test these hypotheses, rats were conditioned to hurdle jump in a shuttle box to avoid electric shock which followed a 500 Hz. tone (CS). After five days of avoidance conditioning the rats were assigned to two treatment and one control groups, matched according to their strength of avoidance responding.

Shock then was discontinued and treatment began. Both treatment groups received equal exposure to the CS tones (phobic stimuli) which were presented in hierarchial arrangement. Initially the treatment CS was an 8,000 Hz., 66 db tone presented for two seconds, following two seconds of a seven second food presentation. On subsequent treatment days the CS became lower, louder and longer. By the fifth (final) treatment day it was equal to the original CS tone used in avoidance conditioning. Food presentation increasingly followed CS onset in the operant procedure and was made contingent upon the animal's making various inhibitory responses involved in confronting the CS for increasing periods without making an avoidance (phobic) response. However, in desensitization the tone onset followed and was concomitant with food presentation.

Following treatment all three groups received five days of extinction, during which the number and latencies of the phobic responses were recorded. Statistical analyses revealed the following:

1. The hypothesis of superiority of the operant procedure as compared with desensitization in reducing phobic behaviors was rejected.

In fact, the desensitization procedure demonstrated a stronger treatment effect—though not significantly so.

2. Both treatments resulted in less resistance to the extinction of phobic behaviors than did the control procedure.

The results of this work are consistent with the view that the treatment of phobic behavior may be accomplished either by rewarding phobic object approach behaviors at the motor level or by the desensitization of anxiety at a more internal level. These results further support a unified view of behavior and experience which would regard changes occurring at one level of overt or covert behavior as having implications for changes at other such levels.

A future determination of the most effective of these two treatments could be accomplished within the experimental framework here introduced by removing certain restrictions which were placed on the operant procedure. These restrictions were regarded as necessary in this present study in order to make the operant treatment more comparable to the operant procedure involved in desensitization.

Desensitization with humans could perhaps be made more effective by employing and maximizing conditioned positive reinforcers, making rewards contingent upon the subject's report of successful progression through the hierarchy of threatening stimulus situations.

INTRODUCTION

Desensitization techniques as introduced by Wolpe (1958) have been successfully employed by many therapists for the relief of primarily psychoneurotic symptoms (Wolpe, 1958; Lazarus, 1961; Lang and Lazovik, 1963; Lazarus, 1963, and Paul, 1966). This study represents an attempt to further our understanding of the processes by which desensitization success is achieved in reducing phobic behaviors. Fears and phobic behaviors are common distressful problems and the treatment of these problems is worthy of investigation.

The term phobic behavior is used here in agreement with Wolpe's (1958) definition as behavior which is persistently maladaptive in view of changed environmental conditions of reinforcement. According to classical conditioning theory (Pavlov, 1927) such phobic behavior is established when a previously neutral stimulus situation is followed closely by punishment. The neutral stimulus will be referred to as the conditioned stimulus (CS) while the punishing situation will be regarded as an unconditioned stimulus (UCS). After repeated presentations of the CS, followed closely by the UCS, the subject (S) reacts to the CS in a manner similar to his reaction to the UCS. This overt avoidance behavior, termed the conditioned response (CR), is generally accepted as a measure of fear on the part of the S learning this phobic behavior. The persistence of phobic behavior in response to the CS, long after removal of the UCS, may be regarded as unadaptive behavior. Treatment of phobic behavior will be defined here as any process which facilitates, or otherwise results in, the reduction

of the overt phobic behavior as a response (CR) to the CS when the UCS ceases to occur. In this study shock (UCS) will be used to condition animals to jump (CR) over a hurdle from one end of a shuttle box to the other in response to a tone (CS). This jumping behavior following onset of the tone persists long after the shock is discontinued. The jumping is regarded as a phobic response rather than an avoidance response under these conditions. A particular interest here is with the explanation of treatment of phobic responses by desensitization.

Counterconditioning or Desensitization

Counterconditioning is the term sometimes used in describing experimental laboratory work with animals which is analogous to desensitization in clinical treatment with humans. However, both terms describe essentially equivalent processes (Wolpe, 1952; 1958). Wolpe bases his desensitization technique on early animal studies using shock as the UCS and using eating responses on the part of the S as the reciprocal inhibitor to the previously conditioned fear (Wolpe, 1952; 1958). This approach was similar to that employed by Watson and Rayner (1920) and Jones (1924); a previously conditioned phobia in a child was treated with food given to the child at progressively diminishing distances to the phobic object.

In a similar vein, flooding (Weinberger, 1965) is the laboratory animal study equivalent of implosive therapy in treating humans (Stampfl and Levis, 1967). This latter treatment involves repeated and continued presentation of the CS until the CR diminishes, in a massed extinction procedure.

The treatment procedure of desensitization, as described by Wolpe (1958), will be employed here with animals. This treatment involves having the phobic animal experience the phobic stimulus while eating food. The CS or phobic stimulus is presented along a dimension of stimulus generalization ranging from weakest to strongest in terms of CR evocative potential. While the animal is eating, the CS is presented in increasingly stronger forms until the original CS form is presented. In working with humans the first step in desensitization is construction of a hierarchial arrangement of stimulus situations which evoke the phobic behavior, arranged from weakest to strongest in terms of their evocative potential. After relaxation training, the subject is asked to imagine these stimulus situations while remaining relaxed. Wolpe cautions that the new response to be learned (relaxation) must be stronger than the unadaptive response to be eliminated (anxiety). Thus, by presenting weak portions of the CS first, and by not progressing to a stronger CS item until all anxiety in response to that CS item has been reciprocally inhibited by the reciprocal inhibitor (relaxation), desensitization will be maintained without hindrance of sensitization (conditioning instead of removing anxiety in response to the CS). This caution on Wolpe's part is important, though not necessarily for the reasons which Wolpe would offer. Gale, Sturmfels, and Gale (1966) found that though this use of progressive approximations in presenting these threatening stimuli (CS) facilitates extinction, this method is most effective when used in conjunction with desensitization. Goldstein's (1967) carefully controlled study suggests that desensitization is more

effective than extinction alone only when progressive approximation in presenting the CS is employed; without hierarchially arranged presentation of the CS, there is no significant difference between extinction and counterconditioning. Thus, the procedure of progressive approximations in presenting the CS is of therapeutic importance, particularly in conjunction with the desensitization treatment method.

Classical Conditioning Explanation of Desensitization

Wolpe (1958) offers an explanation of desensitization based primarily on classical conditioning principles. Wolpe's explanation of desensitization treatment of phobic behavior primarily involves the "masking" or reciprocal inhibition of anxiety by a reciprocal inhibitor, i.e., a response state which is antagonistic to anxiety and which prevents the occurrence of the anxiety. In desensitization, cues which originally evoked anxiety and phobic behavior come to be associated with and come to evoke relaxation, which being antagonistic to anxiety comes to eliminate the anxiety and phobic behavior.

Wolpe (1961), using his principles of reciprocal inhibition, clearly suggests that in desensitization it is the inhibiting properties of the incompatible responses (relaxation) that reduces anxiety and thus eliminates phobic behavior: "if a response inhibitory to anxiety can be made to occur in the presence of anxiety-evoking stimuli so that it is accompanied by a complete or partial suppression of the anxiety response, the bond between these stimuli and the anxiety response will be weakened" (Wolpe, 1961, p. 189). Note that Wolpe

believes that what is treated is the anxiety and not its outward manifestations in the form of observable phobic behavior. Also note that Wolpe believes it is the associations between the CS and internal response states, such as anxiety and relaxation, which are changed in desensitization treatment.

As previously noted, counterconditioning of laboratory animals is the equivalent of the desensitization process. In his research with animals, Wolpe (1952) used eating responses as a reciprocal inhibitor and argued that the neural and physiological responses associated with eating and those associated with fear cannot occur simultaneously because the first are antagonistic to the latter. Thus, in desensitization, eating responses reciprocally inhibit fear and thereby decrease and eliminate those behaviors based on such fear. This study investigates desensitization with animals employing eating responses as the reciprocal inhibitor.

Cautela (1966) offers an explanation of the desensitization process in terms of Pavlovian theory. While relaxed, the subject's cortex is thought to be in a predominantly inhibitory state when the excitatory stimulus (CS) is presented. The excitatory stimulus thus loses its anxiety arousing potential after desensitization. This explanation is similar to Wolpe's in that cue-anxiety bonds are weakened as a result of strengthening of cue-relaxation bonds.

Reciprocal Inhibitors as Rewards

Relaxation responses are most commonly used in desensitization as a reciprocal inhibitor of anxiety. However, a wide variety of other

such inhibitors have been employed including assertive responses (Wolpe and Lazarus, 1966), drugs which induce relaxation (Wolpe and Lazarus, 1966), a comforting relationship (Bentler, 1962), emotive or enjoyable imagery (Lazarus and Abramovitz, 1962), playing responses with children (White, 1959), and eating responses (Wolpe, 1952; 1958). An element common to all these reciprocal inhibitors is their potential reinforcement value in operant conditioning.

Solyom and Miller (1967) have used withdrawal of punishment (termination of shock) instead of relaxation as a "reciprocal inhibitor" in treating phobias. The fact that reciprocal inhibitors can also be positive reinforcers suggests the possibility of operant processes in desensitization treatment of phobic behavior.

Operant Processes in Desensitization

Desensitization involves having the subject imagine increasingly threatening scenes while he is in a state of relaxation. The sequence occurs as follows: relaxation—therapist's suggestion of the imagination of an anxiety provoking image (the CS)—subject's report of having successfully imagined the scene without disturbance—therapist's suggestion that the subject relax (Wolpe and Lazarus, 1966, p. 81). The subject reports whether or not he is disturbed over imagining the scene by signaling with raising his finger. By slowly progressing through the hierarchial list of threatening scenes, from least to most threatening, anxiety experiences on the part of the subject can be eliminated or kept to minimal levels.

Although Wolpe offers an explanation of this process in terms of classical conditioning principles as previously described, an

alternate explanation in terms of operant learning principles appears to be tenable and more parsimonious. Relaxation instructions or any other "reciprocal inhibitor" would serve as a conditioned reinforcer in such an operant explanation. The behavior rewarded would be the subject's self-report of having imagined a threatening scene. As previously noted this self-report is given via finger signal in the desensitization procedure. As the subject reports that he has successfully imagined threatening scenes without experiencing disturbance he is then operantly conditioned to progressively continue in this process until he has imagined the most anxiety provoking scene in the hierarchy. If the subject reports being disturbed in the desensitization procedure then he is presented with previously given discriminative stimuli in the hierarchy and must progress back through the hierarchy again. This procedure could be regarded as operant conditioning of finger elevation (representing the person's report of successful imagination of the threatening discriminative stimulus) in the presence of a fading procedure wherein the discriminative stimuli progress in presentation along a stimulus dimension from least to most threatening in terms of phobic response evocative potential.

The alternate explanation of desensitization in operant terms involves modifying a response by bringing behavior under stimulus control rather than by hypothesizing the reduction or elimination of anxiety, upon which the phobic behavior is based. The sequence of events in desensitization plus the reward potential of reciprocal inhibitors make such an alternate explanation feasible if it can be

shown that reduction of anxiety is not a necessary element in eliminating phobic behavior. Wolpe, as previously described, attributes treatment success of phobic behavior as due to reduction or elimination of anxiety. The successful modification of phobic behavior using an operant procedure would show that reduction of anxiety is not a necessary element in the reduction of phobic behavior, though it might still be regarded as a sufficient element.

Studies Supportive of an Operant Explanation

Studies which have attempted to analyze and study the components of desensitization have shown that whereas relaxation has no treatment value alone (Cooke, 1968; Johnson and Sechrest, 1968), presentation of the CS in hierarchial form without using relaxation does have treatment value (Cooke, 1968; Rachman, 1968; and Rachman and Hodgson, 1967). Thus, it appears that relaxation to counteract anxiety is not a necessary treatment condition; anxiety does not need to be directly eliminated in the successful treatment of phobic behavior.

Wolpin and Raines (1966) found that having subjects simply imagine the original full CS (most threatening scene in the hierarchy) for more than two minutes resulted in extinction of the phobic behavior. Implosive therapy, which involves the technique of flooding whereby the subject is repeatedly presented with the CS in massed and prolonged extinction trials, has been successfully used in eliminating phobic behavior (Hogan and Kirchner, 1968; Stampfl and Levis, 1967). These procedures also make no attempt to minimize or reciprocally inhibit anxiety. Wolpe and Lazarus (1966, p. 140) believe that when such

treatment is sometimes successful, it is only because of "transmarginal (protective) inhibition . . . the diminution of response that is observed when stimulus intensity exceeds a certain limit." However, this does not explain the lasting effect of such treatment to all degrees of stimulus intensity in CS confrontation.

Reduction of phobic behavior is facilitated or phobic behavior is successfully treated when the subject is prevented from making the unadaptive response with repeated presentations of the CS without any presentations of the UCS (Carlson and Black, 1959; Weinberger, 1965). In these studies the subject was prevented from making the unadaptive response (phobic behavior) by utilizing a barrier in a shuttle box, where jumping from one end of the box to the other upon presentation of the CS was defined as the phobic behavior. An operant method of reinforcing the subject to stay in the situation when the CS is presented without the UCS should be equally successful in facilitating elimination of such phobic behavior, demonstrating the possibility of operant processes in desensitization.

Lang and Lazovik (1963) reported that following desensitization of snake phobia, using relaxation as a reciprocal inhibitor, some subjects were able to demonstrate treatment success by touching a snake, in spite of the fact that after treatment they reported <u>no decrease</u> in their pre-treatment anxiety concerning touching a snake. This is exactly what would be expected in terms of an operant learning view of desensitization technique. Other subjects who reported a decrease in anxiety levels following treatment may have been responding to the demand characteristics of the experimental situation (Orne, 1962) or

the expectations of the experimenter (Rosenthal, 1966). Another possibility for decrement in anxiety is that anxiety was experienced and then extinguished in the absence of the UCS during desensitization treatment.

Results of studies cited in this section all demonstrate that anxiety does not have to be reciprocally inhibited in the treatment of phobic behavior. This fact coupled with an alternate explanation of events in the desensitization procedure in terms of operant conditioning leads to the hypothesis that at least part of desensitization success is due to operant procedures.

Formulation of the Hypotheses

Treatment of phobic behavior may involve facilitation of extinction processes. These extinction processes do not always operate. When the subject makes an unadaptive response (CR) in response to the CS, this may preclude the subject from experiencing the absence of the UCS. Furthermore, the frequently short latency between onset of the CS and the occurrence of the CR may serve to prevent an anxiety reaction, thus conserving conditioned anxiety from undergoing extinction (Delude and Carlson, 1964 ; Solomon and Wynne, 1954). Desensitization, operant techniques, flooding/barrier methods, and other procedures used in treating phobic behavior are considered here to be successful to the extent that they allow, encourage or force the subject to experience both the CS and the lack of the occurrence of the UCS, so that extinction can occur.

Wolpe's explanation of desensitization in terms of a primarily classical conditioning paradigm, in which anxiety must be eliminated to eliminate phobic behavior, is questioned here. This explanation requires inferences as to unobservable internal processes which have not been experimentally established (Breger and McGraugh, 1965).

This present study concerns an attempt to show that phobic behavior can be treated effectively by operant methods, concerned only with bringing the subject's observable behavior under stimulus control, without attempting to reduce or eliminate internal anxiety. This bears on the question of the necessity of reciprocally inhibiting anxiety in treating phobic behavior. The first hypothesis is that an operant treatment procedure, presented within the framework of the technique of desensitization, will result in significantly less resistance to extinction compared to the disuse or controlled rest condition.

Previously an alternate explanation was offered of the desensitization process in terms of operant principles rather than in terms of classical conditioning theory. Such an alternate explanation would find support if an operant procedure proved to be a more effective treatment procedure than a desensitization procedure in which operant processes were minimally operative, i.e., restricted to a continuous and simultaneous presentation of reward with the presentation of the CS (so that confrontation with the CS is possibly rewarded). The second hypothesis is that an operant treatment procedure, presented within the framework of desensitization, will result in significantly less resistance to extinction compared to a desensitization procedure, in which operant procedures are minimally involved.

It is assumed that these treatment procedures can be applied to the previously conditioned phobic behavior of animals in the following way. First, using a 500 Hz. tone as the CS, a conditioned avoidance response to shock (UCS) can be established. This response can then be treated by using the progressive approximations method in presenting the CS without the UCS, starting with an 8,000 Hz. tone which does not evoke the avoidance response, then progressing to the original CS (500 Hz. tone). Such progressive presentations of the CS, in hierarchial arrangement from weakest to strongest item, can then be combined with either a desensitization treatment or an operant treatment. In the desensitization treatment the hierarchially arranged conditioned stimuli can be gradually introduced in increasing approximation to the original CS while the animal is eating. The various responses involved in this eating behavior should serve to reciprocally inhibit the anxiety aroused by presentation of the CS tone. In the operant treatment the food is presented in a way such that obtaining it and making an avoidance response are mutually exclusive. In this operant procedure, obtaining food requires that the animal inhibit his making an avoidance response, making instead various other responses which are competitive with the avoidance response, for increasing periods of time.

Both of these procedures can be called effective treatment procedures only if they result in significantly less resistance to extinction than the disuse or controlled rest conditions. Thus, the third hypothesis is that the desensitization treatment will also result in significantly less resistance to extinction compared to the disuse or controlled rest condition.

METHOD

Subjects

Thirty experimentally naive, initially 80 days old Long-Evans male rats were used as subjects. These 30 rats were selected from a group of 42 on the basis of their overall performance during the Acquisition Phase. Selection was accomplished by taking out the four fastest and eight slowest rats in terms of average reaction time between CS onset and CR or hurdle jumping. In the middle of this study three rats died, leaving data on 27 animals (see discussion of matching *Ss* in Treatment section below).

Animal Maintenance

Each animal was separately housed in a hanging, metal cage in a controlled temperature environment. Water was given ad lib in all phases of the experiment. Food was presented ad lib for five days prior to experimentation and then the animals were reduced to 80 per cent of their normal weight. Normal weight was determined by taking the median of the daily weights over the last three days of this five day pre-experimental period. After normal body weight was determined the animals went on their diet for two days prior to beginning acquisition training. They were maintained at 80 per cent of normal body weight during the Acquisition and Treatment Phases of the experiment, but were again placed on an ad lib food schedule during the Extinction Phase of the experiment. The rationale for placing the

animals on an ad lib food schedule during the extinction trials is presented in the Discussion section. All animals were fed each night at the end of the experimental work; Purina Laboratory Chow was used.

Apparatus

The wooden shuttle box was painted black and had interior dimensions of 24 inches long by 6 inches wide by 18 inches high. The floor consisted of 46 copper alloy bars spaced one-half inch apart. The grid floor was divided in half by a four and one-half inch high wooden hurdle which was in place at all times. Only one end of the floor was wired for shock. This same "hot" end also contained a food tray which could be pushed into the side of the box and which was centered between the hurdle and the end of the box.

During the Treatment Phase, 20 mg Noyes food pellets were presented by sliding this tray into the box. The empty tray was kept out of the box, the end of the tray covering the box tray opening, during the Acquisition and Extinction Phases. A plexiglass sheet covered a rectangular opening on one side of the box and permitted full observation of <u>S</u>s' behavior. The other side of the box contained numerous one-quarter inch holes to permit sound to enter from an adjacent speaker.

The shock for the grid was delivered by a Lehigh Valley Electronics Shock Generator and Scrambler unit which reversed the polarity randomly among the 23 grid bars on the hot side of the box. Level of shock was set at one and two-tenths milliamperes (D.C.) as measured by the Simpson meter on the shock unit.

An AR4x speaker was used adjacent to one side of the shuttle box with the woofer near the "hot" end of the box. The tones were supplied from a Hewlett-Packard, model 200AB audio Oscillator. Tones were measured by a General Radio Company Sound-Level Meter, type 1551-B, inside of the shuttle box with background noise at a 35 db level. A Hunter interval timer was used to measure event duration to the nearest hundredth of a second. Manually operated switches controlled the shock, tone and timer. When appropriate the switches from the tone generator could be yoked to the timer to measure the duration of the tone. The running timer was also used to measure food presentation duration.

Procedure

Acquisition Phase

During this Phase each of the 42 rats received 20 trials of acquisition training for each of five consecutive days. On the first trial of each day the animal was placed in the hot end of the shuttle box and allowed to roam for a period of two minutes. The 500 Hz., 90 db tone (the original CS) was then turned on if the animal was in the hot end of the box. If the animal was not in the hot end after the two minute period then he was gently placed there. After the CS tone had been turned on for a period of ten seconds shock was delivered. The CS tone (and shock if turned on) was immediately terminated and time recorded as soon as the animal jumped, withdrawing all contact from the hot grid floor. In effect then the animal quit receiving both the

shock and the tone as soon as he jumped. He did not receive shock prior to ten seconds from the tone onset.

The latency between the onset of the CS tone and the jumping or avoidance response was recorded to the nearest hundredth of a second. Recording of latency was accomplished by having the CS tone duration switch yoked to the timer so that the duration of the CS tone (which terminated with Ss jumping clear of the hot grid floor) was timed. A latency of ten seconds or greater indicated that the animal did not jump before receiving shock.

On trials following the first trial of each day during the acquisition training, the animals were allowed 20 seconds in the "cold" end of the shuttle box following hurdle jumping and CS termination which ended a trial. They did not receive the CS, marking the beginning of a new trial, until at least ten seconds after being placed back in the hot end of the box. Animals jumping within ten seconds of being placed in the hot end of the box to begin a new acquisition trial did not receive either the CS or the UCS (shock) but were gently placed back into the hot end to begin the trial again. Following the 20 daily trials each animal was weighed, returned to his cage and fed an amount of Purina Laboratory Chow based on the deviation of his weight from 80 per cent of his normal weight.

By the fifth day of training, all animals reached the acquisition criterion by hurdle jumping at least 75 per cent of the time before the duration of the CS reached ten seconds (thus avoiding the shock).

Matching

Following the five days of acquisition training all 42 animals were ranked according to their overall average reaction time (between the CS onset and jumping behavior). The four animals with the fastest reaction times as well as the eight slowest reacting animals were discarded from further experimentation. Three groups of ten animals each were then drawn for the two treatment and control groups. The Control group was comprised of the following ranked animals: 1, 6, 8, 12, 14, 16, 20, 22, 27 and 30. The Operant treatment group was made up of animals with these ranked numbers: 2, 4, 9, 10, 15, 17, 21, 23, 25 and 29. The Desensitization treatment group was composed of the following rank numbered animals: 3, 5, 7, 11, 13, 18, 19, 24, 26 and 28. The average reaction time over the 100 trials of acquisition training, computed for each group of ten rats after the animals were formed into the three groups, was as follows: Control group, 4.93 seconds; Operant group, 4.94 seconds; and the Desensitization group, 4.94 seconds. The groups of animals were thus thought to be well matched in terms of the overall average time it took them to jump the hurdle upon onset of the CS during acquisition training.

On the third day of treatment three of the experimental animals, one from each of the three groups, were found dead. Although no autopsy was performed the presence of blood traces near the external urinary region of these animals suggested a urinary tract infection. The remaining 27 Ss survived the experiment, apparently in good health.

The elimination of these three animals did not appear to upset the previous matching. The ranked positions of these Ss, in terms of overall reaction time in the acquisition trials, were 17, 18 and 20.

The average reaction times of the three groups changed as follows with the elimination of the three animals: Control group, dropped from 4.93 to 4.90 seconds; Operant group, remained the same at 4.94 seconds; and the Desensitization group, dropped from 4.94 to 4.93 seconds. Since matching appeared to be maintained the study progressed as scheduled with the remaining 27 Ss.

Treatment Phase

Treatment began the day after completion of the acquisition trials. Both the Operant and the Desensitization treatment groups received equal exposure to the CS stimuli components during treatment. Both groups also received equal exposure to the food pellets used in treatment. The tonal hierarchy presented during treatment in accordance with the method of progressive approximations consisted of the following five tones: an 8,000 Hz., 66 db tone presented for two seconds; a 4,000 Hz., 72 db tone presented for three seconds; a 2,000 Hz., 78 db tone presented for four seconds; a 1,000 Hz., 84 db tone presented for five and four seconds; and a 500 Hz., 90 db tone (original CS) presented for four, six and seven seconds. These tones were presented over the five day Treatment Phase period in a total of 84 treatment trials. Food was also presented. The timing of the food presentation in relation to the tone presentation defined and distinguished the Operant and Desensitization treatment groups. Table 1 provides a detailed description of the tonal hierarchy and the presentation of these CS tones in relation to food pellet presentation in the two treatment groups.

TABLE 1

ONSET AND DURATION OF TONE AND FOOD PRESENTATION IN TREATMENT

		CS Tone	Tone and Food Sequence and Duration in Seconds							
			Operant Treatment				Desensitization Treatment			
Day	Trial	Frequency, Level and Duration	Tone Alone	Food Alone	Food + Tone	Food Alone	Tone Alone	Food Alone	Food + Tone	Food Alone
1	1-16	8,000 Hz. 66 db 2 seconds	-	2	2	3	-	2	2	3
2	1-4	As above	-	2	2	3	-	2	2	3
	5-16	4,000 Hz. 72 db 3 seconds	-	-	3	4	-	3	3	1
3	1-4	As above	-	-	3	4	-	3	3	1
	5-16	2,000 Hz. 78 db 4 seconds	2	-	2	5	-	3	4	-
4	1-4	As above	2	-	2	5	-	3	4	-
		1,000 Hz. 84 db 5 seconds	4	-	1	6	-	2	5	-

5	1-4	1,000 Hz. 84 db 4 seconds	2	-	2	5	-	3	4	-
	5-12	500 Hz.* 90 db* 6 seconds	5	-	1	6	-	1	6	-
	13-20	500 Hz.* 90 db* 7 seconds	6	-	1	7	-	1	7	-

*Original CS

As can be seen from Table 1, both treatment groups received the same stimuli conditions during the 16 trials of the first treatment day and the first four trials of the second treatment day. On the first treatment day each animal was initially put into the hot end of the shuttle box (no longer receiving shock, however) and immediately the filled food tray was pushed inside the box. The animal was allowed either to eat or to roam freely, but as soon as he had eaten from the tray for 30 seconds the food tray was withdrawn. After a ten second delay the tray was reintroduced and two seconds after the animal had again started eating the 8,000 Hz., 66 db tone was turned on for two seconds. After completion of this tone the food tray remained in the box for an additional three seconds and then was withdrawn. There was a ten second interval between trials and S was always in place in the hot end of the box at the beginning of a trial. These first 20 trials combined both operant and desensitization treatment elements but on subsequent and succeeding trials food presentation became increasingly delayed in the operant treatment in a shaping procedure designed to reinforce S's confronting the CS stimulus component, making various other and unmeasured competitive responses, without making the phobic response. The Desensitization group never received the CS tone without prior and concomitant food presentation.

Beginning with the twenty-first trial, which was the fifth trial of the second treatment day, timing of the onset of food presentation began with the introduction of the food tray and not, as previously, with initiation of eating behavior on the part of S. It is impossible to reliably obtain a constant delay of food presentation relative to

previous tone onset when food presentation is defined in terms of S's initiation of eating behaviors, but food presentation defined in terms of food tray introduction can easily be delayed at a fixed period after a tone onset in a consistent and accurate fashion. There was no assurance that S would begin eating as soon as the food was presented in the initial trials because though deprived he had no previous experience with the food's availability. This made it necessary to define the start of food presentation in terms of S's initiation of eating behaviors in these first 20 trials. Stimulus conditions in these first trials made such a definition quite feasible in regards to procedural reliability. After the first 20 trials, Ss had all become acquainted with the food tray's location and availability such that introduction of the food tray was practically equivalent to S's initiation of eating behavior.

After the first treatment day all treatment trials were conducted in the following manner. First an animal was introduced into the hot end of the shuttle box and after a period of at least ten seconds, and while the animal was in the hot end of the box (being gently put back there if he had roamed over the hurdle during the ten second period), the treatment stimuli were introduced. In the case of the operant procedure the treatment stimuli introduction consisted of the onset of the CS tone component followed later by food presentation which was contingent upon the animal's confronting the CS without making an avoidance response. In the desensitization method the onset of the CS tone component followed the food presentation.

As treatment progressed each S was exposed to tones which increasingly approached the original CS tone in terms of frequency or pitch, volume level and duration. Thus, after beginning treatment with a relatively soft, high-pitched and short tone, which had very weak CR evocative potential, treatment ended with the loud low-pitched and long lasting tone used as the CS in the acquisition training. No shock was administered to any animal at any time following the completion of the acquisition training; thus hurdle jumping on the part of S in response to the tone fulfilled the experimental definition of a phobic response. Food was presented for a period of seven seconds in all trials except the last eight trials where it was presented for eight seconds. The stimulus conditions for the two treatment groups are described more precisely in Table 1.

During the Treatment Phase the control animals were transferred from their cages to another cage prior to their daily weighing. This was done to equate all animals for handling. The control animals were not otherwise manipulated and were kept in the same isolated environment receiving the same stimulus exposure as the treatment animals, except of course for the treatment stimuli.

Extinction Phase

The extinction trials began on the day after the fifth (final) treatment day, and consisted of ten trials per day for five consecutive days. These trials were similar to the acquisition trials in most respects. Of course neither UCS (shock) nor food was presented as was the case respectively in the acquisition and treatment trials. Initially

on each day of extinction the animal was placed in the hot end of the box, then allowed to roam for two minutes. During extinction the empty food tray was always pulled in the "out" position so that the end of the tray covered the tray opening in the side of the shuttle-box. At the end of the two minute exploratory period the animal was placed again in the hot end of the box (if he was not already there) and the CS tone (500 Hz., 90 db) was presented and concomitantly was timed. As soon as the animal made a phobic response (by withdrawing all physical contact from the grid floor on the hot side of the box) the CS tone was terminated and simultaneously the timer stopped. If the animal did not jump at the end of 20 seconds, chosen as the infinite latency period, then the CS tone was terminated and his latency was recorded as 20 seconds (indicating that no phobic response was made). This procedure provided measures for the two dependent variables, e.g., latency or delay between onset of the CS and the occurrence of a CR, and whether or not the phobic response or CR was made. After the first trial of each extinction day S was allowed to freely roam for a period of 30 seconds before the CS presentation for the next trial. If an animal made a CR during this pre-trial period then ten seconds later he was placed back into the hot side to begin the 30 second exploratory inter-trial period again.

RESULTS

Data obtained from each of the three phases of this study will be presented in sequential correspondence to the experimental order.

Acquisition Phase

The latency between CS onset and CR occurrence was recorded over the 100 trials (20 trials per day) of acquisition training. A recorded latency of ten seconds or greater indicates that shock was administered on that trial. These data then provide two measures of CR acquisition strength in the speed with which a CR was evoked and in the frequency of CR occurrence prior to UCS onset (or within ten seconds).

Figure 1 demonstrates these data graphically showing the mean number of avoidance responses (CR's) made by each of the three groups for each day of acquisition training.

Inspection of Figure 1 indicates similarity of conditioning rates among the three groups. All of the animals achieved the criterion of avoidance training by making a CR prior to UCS onset at least on 15 of the final 20 acquisition trials.

A one-way analysis of variance on the number of avoidance responses for the final day of acquisition training supported the contention that the three groups of *Ss* had been successfully matched

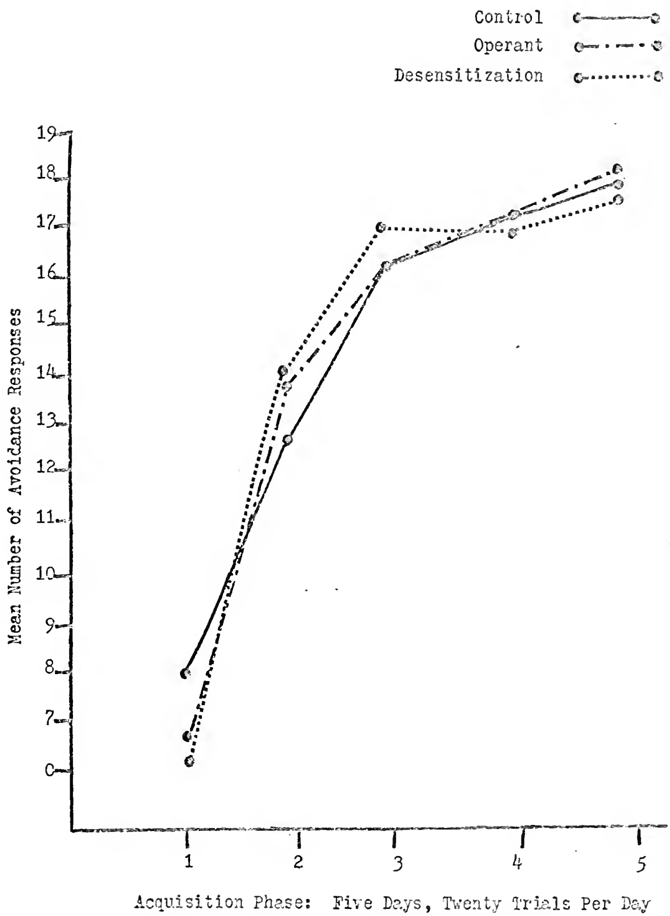

Fig. 1.—Mean number of avoidance responses of three groups of nine subjects over five days of conditioning.

on the strength of acquisition variable. This analysis failed to indicate significant differences among the three groups in number of avoidance responses for the last 20 acquisition trials, as can be seen in Table 2 below.

TABLE 2

ANALYSIS OF VARIANCE OF AVOIDANCE RESPONSE OF THREE GROUPS ON THE FIFTH DAY OF ACQUISITION TRAINING

Sources of Variation	df	Mean Square	F
Between	2	.45	.44
Error	24	1.03	
Total	26		

df (2, 24) .05 = 3.40 .01 = 5.61

Matching was accomplished not on the basis of the number of avoidance responses made prior to the UCS, but rather on the latency of these avoidance responses. The average CS - CR latency by group over all five days of acquisition training was as follows: Operant group, 4.94; Desensitization group, 4.93; and the Control group, 4.90 seconds. These mean latencies for the fifth and final day of acquisition training were as follows: Control group, 3.63; Operant group, 3.27; and Desensitization group, 3.22 seconds. Note that although the Control group demonstrates the fastest overall mean reaction time, indicating strong acquisition of the avoidance response, the Control group's reaction time for the fifth and final day of acquisition training (just

prior to treatment attempts to increase this reaction time) is the slowest of the three groups. As in the case of the number of avoidance responses made during acquisition, the speed with which these responses were made is essentially equivalent among the three experimental groups.

Treatment Phase

The only recording made during the treatment trials was the number of avoidance or phobic responses made by Ss during CS tone component presentation. In the Desensitization group, which received food prior to and continuing throughout exposure to the CS tones, only two of the nine animals made phobic responses. These two animals only made one such response each for a total of two, and these two responses were both made only on the first treatment day. In the Operant group, which received food usually seconds after the onset of the CS tones, eight of the nine Ss made a total of 21 (of a possible 756 total trials) phobic responses. Table 3 describes the distribution of these 21 phobic responses over the five treatment days. Examination of the data in Table 3 reveals that the operant fading procedure employed was generally successful in maintaining the desired behavior, and that a small percentage of phobic responses occurred.

Both treatments appear to have been accomplished successfully. The nearly total prevention of CR occurrence in the desensitization procedure attests to the effectiveness of the hierarchy used. Probably the only way to have eliminated CR occurrence in the operant treatment would have been to make food presentation less delayed relative to CS onset, but this would have blurred the distinction between the two

TABLE 3

DAILY TOTAL NUMBER OF PHOBIC RESPONSES MADE BY THE OPERANT ANIMALS OVER FIVE TREATMENT DAYS

	Treatment Day Number and Number of Treatment Trials Per Each Animal				
Animal	Day 1 16 Trials	Day 2 16 Trials	Day 3 16 Trials	Day 4 16 Trials	Day 5 20 Trials
1	0	0	0	0	1
2	1	1	2	1	0
3	0	0	0	0	2
4	2	0	1	0	3
5	0	0	0	1	2
6	1	0	1	0	0
7	0	0	0	0	0
8	0	0	0	0	1
9	0	0	0	0	1

treatment groups; the operant treatment would have become more of a desensitization treatment.

Extinction Phase

Treatment effects were measured during the extinction trials both by the number of phobic responses made and by the latency in responding. These data can be found in Appendices A, B and C. Considering the number of avoidant responses made by the three groups in the extinction curves in Figure 2, differences among the groups are readily noted. These differences are further reflected in the means and standard deviations of the avoidance responses as contained in Table 4. Both treatment groups made less phobic responses during post-treatment extinction trials than did the nontreated controls. This difference was most evident on the first day of extinction, immediately following the last treatment day. A two-way, mixed model (Hays, 1966) analysis of variance is summarized in Table 5. These results require the rejection of the hypothesis that the three groups were sampled from the same population. To further describe differences attributable to treatment, a Newman-Keuls test is presented in Table 6. These results indicate that both the Desensitization and Operant treatment groups are significantly different from the Control group, but that the Operant and Desensitization groups are not significantly different from each other. Thus, the significant treatment effect is primarily due to differences between the treated and untreated groups. Changes over "days" of the extinction trials are to be expected; the significant effect of this variable is of little concern to this

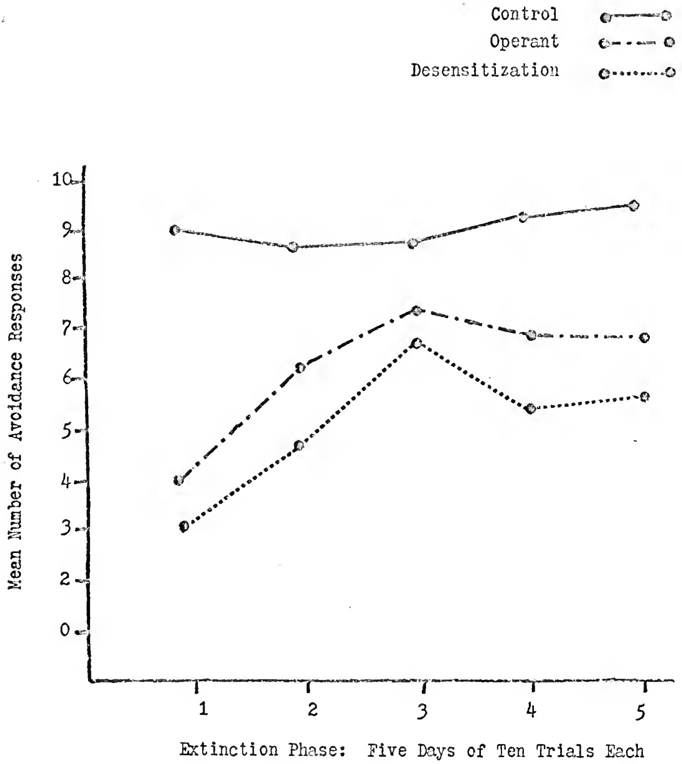

Fig. 2.—Mean number of avoidance responses of three groups of nine subjects over five extinction days.

TABLE 4

MEANS AND STANDARD DEVIATIONS OF NUMBER OF PHOBIC RESPONSES MADE DURING THE FIVE DAYS OF TEN TRIALS PER DAY EXTINCTION PHASE

		Extinction Day				
Group		1	2	3	4	5
Desensitization	$\bar{X}$	3.2	4.7	6.8	5.4	5.6
	S_D	3.18	3.64	2.47	1.72	2.70
Operant	$\bar{X}$	4.2	6.0	7.3	6.7	6.7
	S_D	3.35	2.58	2.99	2.79	2.94
Control	$\bar{X}$	8.9	8.6	8.7	9.3	9.4
	S_D	.89	1.61	1.59	1.03	1.14

TABLE 5

ANALYSIS OF VARIANCE OF NUMBER OF PHOBIC RESPONSES MADE BY THE THREE GROUPS OVER FIVE DAYS OF EXTINCTION

Source of Variation	df	Mean Square	F
Treatment	2	177.80	36.14**[a]
Days	4	19.85	2.93*[b]
Interaction	8	4.92	.73[c]
Error	120 (128)[d]	6.90 (6.78)[d]	
Totals	134		

[a]df (2, 8) .05 = 4.46 .01 = 8.65

[b]df (4, 128) .05 = 2.42

[c]df (8, 128) .05 = 2.01

[d]Pooled MS error, used to test Days and Interaction effects

TABLE 6

POST-HOC COMPARISONS[a] OF THE THREE GROUPS IN NUMBER OF AVOIDANCE RESPONSES DURING EXTINCTION

	Treatment Methods				
	Desensitization		Operant		Control
Treatment Totals	231		278		404
Differences		47		126	
Differences $\div \sqrt{n \text{ MS error}}$		2.72[b]		7.15**[c]	

[a]Newman-Keuls Test

[b]$Q_{.95}\ (2, 120) = 2.80$

[c]$Q_{.99}\ (2, 120) = 3.70$

investigation. It should be noted that complete extinction did not occur, and that the treatment effects were measured during but not throughout the extinction process. The "days" factor in the analysis of variance of number of phobic responses was regarded statistically as a random factor, sampled from all possible extinction days.

Turning now to the second dependent variable, phobic response latency, differences among the three groups can be seen in the extinction curves of Figure 3. These differences are most evident, as in the case of the phobic response occurrence variable, immediately after treatment on the first day of extinction. Also, as in the case of the first dependent variable, both treatment groups appear to be clearly superior to the Control group in decrement of phobic behavior and the densensitization treatment appears perhaps more effective than does the operant procedure. The means and standard deviations of these latency data are presented in Table 7. Analysis of the variance of these results, summarized in Table 8, again as in the case of the first dependent variable, demonstrates a strong treatment effect. A two-way, mixed model analysis was employed with an error term for testing interaction and row effects (the random effects variable) derived by pooling the interaction and error mean squares, again as was done in the first dependent variable analysis of variance.

To more precisely delineate the effect of treatments on latency of the phobic response during extinction another Newman-Keuls test was calculated (Table 9). These results again parallel those obtained with the CR occurrence data previously described in that either the Desensitization or Operant groups were significantly slower in responding to the

CS than was the Control group, but that the two treatment groups miss being significantly different.

The effect of desensitization and operant procedures in the reduction of two behavioral indices of phobic behavior appears to be highly facilitative as compared with no treatment procedure at all, but the hypothesis that the two successful treatment procedures differed in effectiveness escaped rejection and the differences found in this study must await future investigation for clarification.

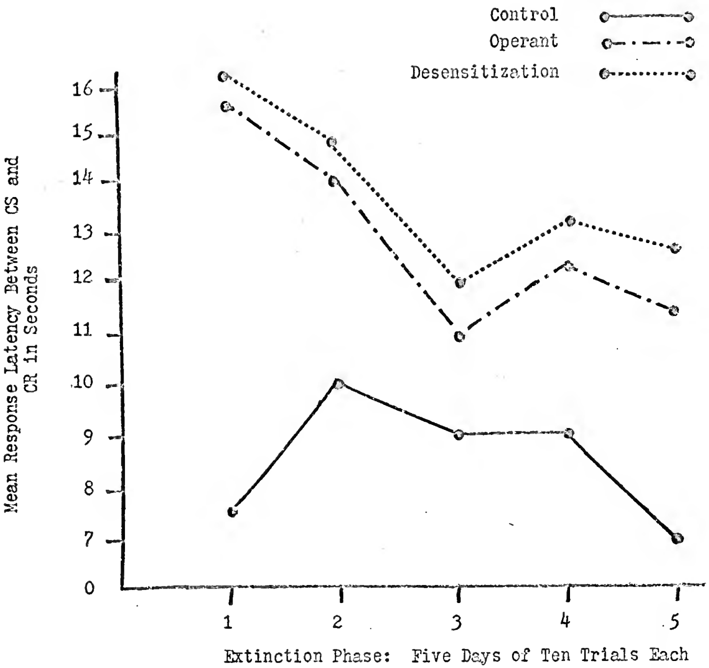

Fig. 3.—Average time between CS onset and phobic response of three groups of nine subjects over five extinction days.

TABLE 7

MEANS AND STANDARD DEVIATIONS OF CS - CR LATENCIES OF THREE GROUPS OVER FIVE EXTINCTION DAYS

Group		Extinction Day 1	2	3	4	5
Desensitization	$\bar{X}$	16.09	14.83	11.97	13.63	12.44
	S_D	4.68	5.35	3.69	3.50	6.03
Operant	$\bar{X}$	15.24	13.73	11.10	12.31	11.16
	S_D	3.91	3.45	4.08	3.48	4.01
Control	$\bar{X}$	7.55	9.72	8.87	8.85	7.09
	S_D	2.18	4.33	2.74	3.58	4.58

TABLE 8

ANALYSIS OF VARIANCE OF CS - CR LATENCIES OF THREE GROUPS OVER FIVE EXTINCTION DAYS

Source of Variation	df	Mean Square	F
Treatment	2	356.08	28.72**[a]
Days	4	39.08	2.20[b]
Interaction	8	12.40	.70[c]
Error	120 (128)[d]	18.12 (17.76)[d]	
Total	134		

[a]df (2, 8) .05 = 4.46 .01 = 8.65

[b]df (4, 128) .05 = 2.42

[c]df (8, 128) .05 = 2.01

[d]Pooled MS error, used to test Days and Interaction effects.

TABLE 9

POST-HOC COMPARISONS OF THE THREE GROUPS IN LATENCY OF AVOIDANCE RESPONSE DURING EXTINCTION

	Treatment Methods				
	Desensitization		Operant		Control
Treatment Totals	620.63		572.85		381.43
Differences		47.78		191.42	
Differences ÷ $\sqrt{n \text{ MS error}}$		1.67[a]		6.70**[b]	

[a] $Q_{.95}$ (2, 120) = 2.80

[b] $Q_{.99}$ (2, 120) = 3.70

DISCUSSION

Analysis of the acquisition data indicates that successful matching of groups was achieved in this investigation so that the three groups of animals had approximately equal conditioned avoidance response tendency prior to the treatment phase. Thus the three groups were probably nearly equal in the strength of their phobic response tendency, and were probably also nearly equal in their ability to "unlearn" the previously conditioned avoidance response, when treatment began.

Data obtained during the Treatment Phase indicate that both treatments changed the rate of the avoidance responses of the animals during treatment trials. Both treatment groups received a nearly equal exposure to the CS throughout this experiment, so that the treatment effect involved in CS exposure was equivalent among treatment groups. Treatment effects due to extinction were considered minor since the phobic behaviors of the Control group on the fifth (final) day of extinction trials were nearly equal to those on the first day of extinction, and since the phobic behaviors of the Control group on the final day of extinction were much greater than those of either the Operant group or the Desensitization group on the first day of extinction. Both treatment groups also received an equal opportunity to eat during treatment. All S̲s were maintained on similar food deprivation schedules prior to and during the first two phases of this study, and all the groups were fed ad lib during the final phase.

The reason for changing to an ad lib food schedule in the final experimental phase was to achieve what was thought to be a more pure measure of the effects of treatment by reducing deprivation effects on response maintenance. Under food deprivation conditions the operant treatment would have measured out as more effective than was the case. The fact that the measures of phobic behavior on the final two days of extinction, when any food expectation should have extinguished to a large degree, are very similar to these same measures over all five days of extinction suggests that food expectation played a minor role in the effects of treatment (as measured with well-fed animals).

Effects of operant procedures are typically measured after removal of previous reinforcement, but not necessarily while needs satisfied by the reward are reduced to a state of satiation. In attempting to measure more lasting effects of treatment, rather than temporary and perhaps artificial effects, the operant treatment was hampered in this investigation.

The operant procedure employed was a discriminative differential reinforcement of other behaviors. The desired event in the operant procedure, not jumping, involved a variety of inhibitory responses (largely superstitious in nature). It was these varied unmeasured inhibitory responses which were actually reinforced. These reinforced responses, which were somewhat incompatible and antagonistic to the phobic response, were brought under the control of discriminative stimuli presented along stimulus dimensions (frequency, loudness, and duration of tone) through a fading procedure. The tone came to serve as a discriminative stimulus for food presentation in the operant

procedure. During the extinction trials, when the animals were satiated for food, the tone was irrelevant as a discriminative stimulus, making the operant animal much more likely to make the phobic response than would have been the case had the food-deprivation schedule been continued. However, by providing all animals with food during the Extinction Phase, the operant treatment procedure more closely approximated the hypothesized operant elements in the desensitization treatment. The desensitized animal demonstrates his treatment effect whether food deprived or food satiated and any operant procedure involved in the desensitization treatment must also stand up under food-satiation conditions.

A one-way shuttle box was used such that one side consistently received shock during acquisition, food during treatment, and the CS during all experimental phases. If a two-way shuttle box had been used, in which both sides alternately received shock, then both ends of the box would have taken on an aversive quality for the animals. This potential source of confusion for the animals was avoided, though thereby probably making treatment more difficult, by consistently offering the animals a sanctuary in the no-shock end of the box. Thus the quick phobic response was always clearly associated with avoidance of shock, and was always an available course of action to the animal.

The operant treatment involved the reinforcement of responses involved in an animal's confronting the CS without making a phobic response. These reinforced responses were shaped in that their occurrence over increasing periods of time was required in order to obtain food. Operant treatments usually attempt to increase the rates of more active

and positive responses. However, in the experimental procedure employed here, the reinforcement of a single, active response might have introduced desensitization elements in that the active responses would have involved inhibition of anxiety. Wolpe (1958) describes how an active motor response can reduce anxiety, even though this motor response does nothing toward the avoidance of the threatening stimulus. The choice of rewarding a passive CS confrontation response avoided these problems and thus more clearly offered a test of motor level operant conditioning versus more central (perhaps) autonomic level anxiety inhibition. If an active, positive, clearly defined competing motor response had been positively reinforced then the operant treatment would probably have measured out as more effective than was the case. But again this does not correspond to the hypothesized role of an operant procedure in desensitization in that desensitization does not involve the occurrence of an active, positive motor response. In human desensitization, finger raising serves as a signal rather than as a competing response antagonistic to the phobic response. Thus, to make the operant procedure most comparable to the operant procedure that might operate in desensitization, no clearly defined rewarded response was employed.

Results from the Extinction Phase suggest that contrary to our hypothesis the operant treatment is not superior to the desensitization procedure. However, and as hypothesized, both treatments were significantly effective as compared to a no treatment condition. Before discussing possible implications of these results it must be pointed out that the measures of treatment effect were taken from extinction trials

that did not continue to completion. The question arises as to whether the treatment differences demonstrated would have continued in the same form if the trials had gone on to total extinction. Statistically this was controlled to an extent by regarding the "days" factor in the analysis of variance as having a random rather than fixed effect, thus taking the five days measured as a sample rather than as exhaustive of the universe of "Days." It is most likely that data obtained from all possible extinction trials would have yielded the same results as the data actually obtained. The most probable exception to this is that the desensitization treatment might have been shown to be significantly superior to the operant procedure employed in terms of reducing number of phobic responses made, since this was nearly so with the data obtained.

A major finding in this study is that an operant procedure, which most closely approximated such a possible procedure in desensitization, was found to be slightly less effective (though this was not statistically significant) than a desensitization procedure in the reduction of phobic behaviors. All other sources of treatment effect, not specifically and uniquely a part of the two treatment procedures employed, were equivalent in the two treatments. Such sources of treatment effect which were equivalent in both treatments include (1) extinction possibilities, (2) change from conditioned aversive qualities to conditioned adient qualities of the hot end of the shuttle box through food presentation in treatment, and (3) opportunities for making various motor responses. The CS tone was of different stimulus

value for the two treatment groups, serving as a discriminative stimulus for food presentation in the operant procedure while serving as a CS for response states involved in eating (presumedly incompatible with previously conditioned anxiety response states) in the desensitization procedure. However, these differences in the tone's value, primarily in its value as a conditioned reinforcer, are differences inherent in the differences between the two treatment procedures. And whereas the CS tone's value as a discriminative stimulus was much reduced during the extinction trials (when the food schedule became ad lib) this again more closely approximated any possible operant procedure involved in desensitization. Therefore, the desensitization treatment effect may involve some possible operant conditioning treatment effect, but it is not dependent upon such operant elements. At any rate this study supports the view that either the operant or the desensitization procedure is similarly effective in reducing phobic behavior. This finding has some implications for further elucidation of the desensitization process and for treatment of phobic behavior in general.

In regard to the nature of the desensitization process, contrary to the view initially offered here, it appears that the desensitization treatment effect involves more than either rewarded confrontation with the phobic object or reinforced induction of competing motor responses. The operant treatment contained these two elements plus the additional advantage of a more efficient use of reward in using fading and shaping procedures designed to more strongly condition motor responses than could be accomplished by the continuous and simultaneous "reward" offered as part of the desensitization treatment. The additional

treatment effect element, which is necessarily a part of the desensitization treatment to a greater extent than in the operant treatment, could be a deconditioning of anxiety previously conditioned to the stimulus represented by the phobic object. This deconditioning might occur as a result of two processes: the weakening or reciprocal inhibition of conditioned bonds between anxiety affect and the phobic stimulus, and a simultaneous strengthening or reconditioning of bonds between the phobic stimulus and pleasant affect (a process which could also serve to reciprocally inhibit anxiety). This might involve a response state substitution to the same stimulus via classical conditioning.

But regardless of such conjecture, it does appear that phobic behavior can be treated by changing motor behavior in the direction of approach rather than avoidance, without dealing with anxiety directly. Phobic behavior treatment is also enhanced by reducing phobic anxiety, perhaps by a process involving the substitution of conditioned adient affect for previously conditioned aversive affect.

There is currently a continuing debate between behavior modification learning theorists and analytically oriented theorists regarding the necessity of dealing with internal "causes" in treatment of neurotic symptoms (Ullmann and Krasner, 1965). Related to this issue is the differing view of phobias held by psychoanalysts and behavior modifiers. Psychoanalysis traditionally regards phobias as generated from anxiety which is displaced onto the phobic object, whereby avoidance of the phobic object while being fearful of that object becomes a

means by which the anxiety is kept in check. Analytic treatment of phobias is accomplished through uncovering the source of the anxiety in terms of the unconscious dynamics and intrapsychic conflicts involved. After this underlying material is brought into full cognitive and emotional awareness then the anxiety is dispelled and the phobia is reduced. In contradistinction to this view, the behavior modification approach would regard phobias in terms of behavior that originates from prior aversive conditioning which is best treated by elimination of the phobic behavior or modification of verbal behavior. Thus Eysenck's (1960) dictum: "Get rid of the symptom and you have eliminated the neurosis" (p. 9).

Wolpe, in arguing for the progressive deconditioning or inhibition of the phobic anxiety in treating phobic behavior stands somewhere between the analyst, who would resolve the underlying conditions which give rise to the displaced phobic anxiety, and the behavior modifier, who would change the phobic (motor level) behavior. The differences in these three approaches to the treatment of phobic behavior can then be regarded in terms of the level of the phobic experience at which attempted change is primarily focused. The results of this research suggest that either motor level behavior or more central levels of response states can be the primary change target in effective treatment of phobic behavior. However, it must be remembered that our definition of phobic behavior is based on a learning theory model and not on the psychoanalytic "phobia." There may well be different types of phobias corresponding to the differing definitions of phobias found in psychoanalysis and learning theory.

Treatment of phobic behavior may best be accomplished by inducing changes at all levels of experience and behavior. But in recent years there has been increasing support for the view that behavior, however conveniently studied at isolated and restricted levels, is very much unified.

Social psychologists, particularly the cognitive dissonance researchers, have well demonstrated how changes in overt behavior can bring about internal changes in cognition, attitude, and affect. The operant animal in this study who was rewarded for confronting threatening stimuli probably experienced a fear reaction which likely underwent some extinction so that changes in affect followed motor level changes. Likewise, the subject whose fear was diminished was enabled to make subsequent motor level changes. Freud (1925) found it most helpful in treating phobias to make his phobic patients expose themselves to previously avoided and painful situations. The results of this study are consistent with a unified view of behavioral change such that change at any level of experience has important implications for subsequent changes at other levels of overt and covert behavior.

The method presented here, of equitably comparing operant with desensitization methods, would seem worthy of further extension and exploration. Hopefully, with more sophisticated measuring techniques and more refined procedures, future research will be able to demonstrate how much the treatment of phobic behavior depends on the resolution of anxiety engendering deep-seated conflicts versus reduction in specific conditioned anxiety versus change in motor level behavior. It might also be possible to more precisely determine how much desensitization

depends on the inhibition of general anxiety versus specific conditioned anxiety, and to determine how much desensitization involves instrumental conditioning of either approach behaviors or competing motor responses. Such research is particularly needed with human subjects.

Although the purpose of this study was not to determine the comparative efficacy of the two treatments employed, such an evaluation could be accomplished within the experimental framework here introduced. In all fairness to the operant procedure, such a study would require the reinforcement of a clearly defined, active motor response (competitive to the phobic response). In the same vein, food deprivation conditions should continue throughout the extinction trials in any such treatment comparison.

Since operant procedures are effective in bringing about confrontation with a phobic stimulus, desensitization with humans could perhaps be made more effective by maximally employing verbal reinforcement which could be made contingent upon the subject's self-report of having imagined an item in the hierarchy of threatening stimulus situations. Therapist reinforcement of the subject's actual confrontations with the phobic object could also be combined with desensitization in an attempt to bring about changes at many levels of behavior and experience in eliminating human phobias.

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APPENDICES

APPENDIX A

EXTINCTION PHASE: DAILY AVERAGE LATENCY RECORDED TO THE NEAREST HUNDREDTH OF A SECOND AND SUMMED NUMBER (GIVEN PARENTHETICALLY) OF AVOIDANCE RESPONSES MADE BY THE CONTROL GROUP OF TEN TRIALS OVER FIVE DAYS

	Days				
Animals	1	2	3	4	5
1	10.85 (8)	11.32 (8)	9.01 (9)	12.38 (9)	5.56 (10)
2	4.42 (10)	5.38 (10)	8.73 (9)	8.76 (9)	6.46 (9)
3	5.69 (9)	1.82 (10)	5.88 (10)	3.43 (10)	1.94 (10)
4	7.58 (10)	9.72 (10)	10.40 (10)	9.74 (9)	7.88 (10)
5	5.79 (9)	7.98 (10)	3.93 (10)	7.04 (10)	2.48 (10)
6	6.89 (9)	12.74 (6)	12.50 (6)	8.53 (10)	12.22 (9)
7	9.75 (8)	14.01 (6)	6.41 (10)	12.89 (10)	9.55 (9)
8	10.57 (8)	14.65 (8)	13.07 (5)	10.82 (8)	11.10 (8)
9	6.38 (10)	9.86 (10)	9.90 (9)	8.82 (9)	6.60 (10)

APPENDIX B

EXTINCTION PHASE: DAILY AVERAGE LATENCY RECORDED TO THE NEAREST HUNDREDTH OF A SECOND AND SUMMED NUMBER (GIVEN PARENTHETICALLY) OF AVOIDANCE RESPONSES MADE BY THE OPERANT GROUP OF TEN TRIALS OVER FIVE DAYS

	Days				
Animals	1	2	3	4	5
1	17.33 (2)	12.33 (6)	11.25 (8)	16.23 (4)	10.80 (7)
2	10.68 (8)	9.62 (8)	9.14 (10)	11.24 (8)	6.60 (10)
3	10.11 (9)	12.07 (7)	6.40 (10)	11.36 (9)	8.26 (8)
4	18.70 (1)	15.01 (7)	8.76 (9)	9.81 (8)	11.34 (8)
5	15.59 (5)	8.98 (8)	8.33 (9)	10.08 (8)	7.53 (10)
6	20.00 (0)	18.42 (3)	10.68 (7)	10.79 (7)	8.20 (7)
7	20.00 (0)	20.00 (0)	20.00 (0)	20.00 (0)	20.00 (0)
8	13.50 (7)	13.22 (7)	12.96 (7)	8.12 (10)	12.98 (5)
9	11.24 (7)	13.90 (7)	13.41 (6)	13.19 (6)	14.69 (6)

APPENDIX C

EXTINCTION TRIALS: DAILY AVERAGE LATENCY RECORDED TO THE NEAREST HUNDREDTH OF A SECOND AND SUMMED NUMBER (GIVEN PARENTHETICALLY) OF AVOIDANCE RESPONSES MADE BY THE DESENSITIZATION GROUP OF TEN TRIALS OVER FIVE DAYS

	Days				
Animals	1	2	3	4	5
1	13.17 (4)	17.69 (2)	9.01 (9)	12.38 (7)	18.90 (1)
2	19.57 (1)	16.88 (8)	12.30 (6)	18.55 (2)	18.33 (1)
3	19.53 (1)	8.59 (7)	13.60 (6)	11.02 (7)	10.86 (7)
4	19.53 (1)	17.05 (4)	15.71 (5)	14.06 (5)	8.74 (8)
5	20.00 (0)	20.00 (0)	12.36 (8)	19.30 (1)	13.10 (4)
6	20.00 (0)	19.40 (2)	14.20 (5)	16.34 (4)	12.00 (6)
7	7.69 (9)	5.89 (10)	7.16 (10)	11.59 (8)	8.72 (9)
8	15.69 (3)	20.00 (0)	17.53 (2)	11.12 (7)	15.00 (4)
9	9.61 (7)	8.00 (9)	5.88 (10)	8.27 (8)	14.69 (9)

BIOGRAPHICAL SKETCH

Arthur M. Wells, Jr., was born on October 9, 1939, at Birmingham, Alabama. He moved to Florida in 1949, where he attended public schools. He was graduated from Ft. Lauderdale High School in June, 1958. In August, 1962, he received the degree of Bachelor of Arts from the University of Florida. During the summer of 1961, he worked with maladjusted children under David Wineman while attending the University of Michigan. In August, 1965, he received his Master of Rehabilitation Counseling degree from the University of Florida. After working for one year in Miami, Florida, as a Rehabilitation Counselor, he returned to the University of Florida to work toward his doctorate in psychology. During his graduate studies in psychology, he was a Vocational Rehabilitation Administration fellow. In August, 1969, he completed a one year's internship in clinical psychology at the J. Hillis Miller Health Center. Since September, 1969, he has worked as a psychologist at the Northeast Florida State Hospital in Macclenny, Florida.

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Arthur M. Wells is married to the former Anastasia E. Lawlor. He is a member of Psi Chi and Phi Kappa Phi.

This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Arts and Sciences and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

March, 1970

Dean, College of Arts and Sciences

Dean, Graduate School

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